# 3.2 Medical Requirements Overview

**TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW** 

MRID# and Title:	MR001S Operational Tilt Test
Sponsor:	Medical Operations
IPT:	Cardiovascular
Category:	Medical Requirements (MR)
References:	Astronaut Medical Evaluation Requirements Document (AMERD) JSC 24834, Appendix B, Section IV (4.1 a, 4.2 a, 4.2 b, 4.2 c)
Purpose/Objectives:	Stand tests are used to assess the effects of prolonged weightlessness on orthostatic tolerance during upright posture. Attempts are made to identify high-risk crewmembers before their current flight and adjust their in-flight countermeasures accordingly, such as varying the proportion of aerobic versus resistive exercise and adjusting end-of-mission countermeasures. Postflight data are used to guide rehabilitative measures and optimize performance on future flights. Group data are used to assess the influence of other physical and physiological factors such as countermeasures, mission duration, heat stress, etc.
<b>Measurement Parameters:</b>	Supine and standing blood pressure, heart rate, stroke volume, cardiac output, and total peripheral resistance (TPR).
Deliverables:	A cardiovascular status assessment which will provide a basis for in-flight countermeasure treatments, an evaluation of the prescribed countermeasures, and a determination of a crewmember's postflight recovery status.
Flight Duration:	< 30 days
Number of Flights:	All
Number and Type of Crew Members Required:	All rookie astronauts and/or first-time Shuttle flyers; all crewmembers who had orthostatic intolerance after their previous mission
Other Flight Characteristics:	Pre- and postflight data collection only

# ${\bf 3.3} \qquad {\bf Preflight\ Training-No\ Preflight\ Training}$

## 3.4 Preflight Activities

#### **TABLE 3.4: PREFLIGHT ACTIVITIES**

Description: -	wmember will be instrumente Supine (~6 min.)	ed and place	d on tilt table (~5 min.)					
_	Supine (~6 min.)		Crewmember will be instrumented and placed on tilt table (~5 min.)					
		- Supine (~6 min.)						
-	- Upright (80° tilt) (~10 min.)							
-	- Questionnaire (~2 min.)							
Para	ameters: 2-D echocardiograph	hy and Dop	oler ultrasound for deter	mination of stroke v	olume, cardiac o	output and total peripheral		
	Parameters: 2-D echocardiography and Doppler ultrasound for determination of stroke volume, cardiac output and total peripheral resistance, 3-lead ECG, and heart rate recording, minute-to-minute manual blood pressure, and beat-to-beat non-invasive blood							
press	pressure via Finapres. (See page 3 for Test Termination Criteria).							
	Duration:	S	Schedule:	Flexibility:		Personnel Required:		
Calcalata				·		•		
Schedule:	Operation Tilt Test:	I	∠-10 days	N/A	Lab	personnel/Crewmember		
	30 minutes		•	Zue personner erewine				
Ground Support Requirements	Preflight Hardware: Preflight Software: Test Location:							
Hardware/Software								
	Tilt Table	ble N/A				U.S.		
Fing	Finger beat-to-beat blood pressure monitor N/A				U.S.			
	Teac recorder N/A				U.S.			
	ECG monitor N/A				U.S.			
	Ultrasound unit N/A				U.S.			
	Blood pressure monitor					U.S.		
	Strip chart recorder		N/A		U.S.			
Testing Facilities Min	nimum Room Dimensions:	Number	of Electrical Outlets:	ets: Temperature Requireme		Special Lighting:		
			isolated and protected					
	12' x 12'		hat have their own 72 °F None		None			
		independe	dent power source					
Hot	t or Cold Running Water:	Privacy Requirements:		Vibration/Acoustic Isolation:		Other:		
		Limit to 3 operators and						
	None		flight surgeon	None		None		
	See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior							
to tes	esting, no heavy meals 4 hr pr	ior to testin	g and no food at all 2 hr	prior to testing.				

Launch Delay Requirements:	Data collection will be repeated if launch is delayed by more than 3 months.
Notes:	N/A
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):
	A preliminary test report will be delivered by Discipline lead or designated lab personnel to the Flight Surgeon no later than the L-3 date. The preliminary test report and final, completed data analysis report will be submitted to the Flight Surgeon and Data Activist no later than 3 weeks after the completed session.

Test Termination Criteria: If any of the following instances occur while the crewmember is standing, the crewmember will be laid down and monitoring continued until the subject is stable.

- 1. A sudden drop in heart rate greater than 15 beats per minute.
- 2. A sudden drop in blood pressure (systolic fall >25 mm Hg or diastolic fall > 15 mm Hg).
- 3. Significant cardiac arrhythmias:
  - a. Bradyarrhythmias (example: heart rate < 40 for people whose resting heart rate is > 50)
  - b. Tachyarrhythmias (3 or more beats in a row of supraventricular or ventricular tachycardia)
  - c. Evidence of heart block other than first degree
  - d. PVC's which meet any of the following criteria:

Six or more PVC's per minute

PVC's that are closely coupled

PVC's that fall on the T wave of the preceding beat

PVC's that occur in couplets or runs

PVC's that are multi-formed

- 4. An absolute systolic blood pressure < 70 mm Hg
- 5. Severe nausea, clammy skin, perfuse sweating, pallor, light-headedness, dizziness, or tingling
- 6. Crewmember request at any time.

# 3.5 In-Flight Activities – No In-Flight Activities

## 3.6 Postflight Activities

#### **TABLE 3.6: POSTFLIGHT ACTIVITIES**

Supine (~6 min.)   -	TABLE 5.0: FOSTFLIGHT ACTIVIT							
- upright (80° tilt) (~10 min.) - Questionnaire (~2 min.) - Parameters: 2-D echocardiography and Doppler ultrasound for determination of stroke volume, cardiac output and total peripheral resistance, 3-lead ECG, and heart rate recording, minute-to-minute manual blood pressure, and beat-to-beat non-invasive blood pressure via Finapres. (See page 3 for Test Termination Criteria).    Duration:   Schedule:   Flexibility:   Personnel Required:	Postflight Activity	Crewmember will be instrumented and placed on tilt table (~5 min.)						
Parameters: 2-D echocardiography and Doppler ultrasound for determination of stroke volume, cardiac output and total peripheral resistance, 3-lead ECG, and heart rate recording, minute-to-minute manual blood pressure, and beat-to-beat non-invasive blood pressure via Finapres. (See page 3 for Test Termination Criteria).    Schedule:   Flexibility:   Personnel Required:	Description:							
- Questionnaire (~2 min.) - Parameters: 2-D echocardiography and Doppler ultrasound for determination of stroke volume, cardiac output and total peripheral resistance, 3-lead ECG, and heart rate recording, minute-to-minute manual blood pressure, and beat-to-beat non-invasive blood pressure via Finapres. (See page 3 for Test Termination Criteria).    Schedule:   Duration:   Schedule:   Flexibility:   Personnel Required:								
Parameters: 2-D echocardiography and Doppler ultrasound for determination of stroke volume, cardiac output and total peripheral resistance, 3-lead ECG, and heart rate recording, minute-to-minute manual blood pressure, and beat-to-beat non-invasive blood pressure via Finapres. (See page 3 for Test Termination Criteria).    Schedule:   Schedule:   Flexibility:   Personnel Required:								
resistance, 3-lead ECG, and heart rate recording, minute-to-minute manual blood pressure, and beat-to-beat non-invasive blood pressure via Finapres. (See page 3 for Test Termination Criteria).    Duration:   Schedule:   Flexibility:   Personnel Required:			hy and Dop	pler ultrasound for deter	mination of stroke v	olume, cardiac o	output and total peripheral	
Pressure via Finapres. (See page 3 for Test Termination Criteria).   Duration:   Schedule:   Flexibility:   Personnel Required:								
Duration:   Schedule:   Flexibility:   Personnel Required:								
Operation Tilf Test 30 minutes   R+0 R+3* R+3* R+10*   R+10*		Duration:	5	Schedule:	Flexibility:		Personnel Required:	
Operation Tilf Test 30 minutes   R+0 R+3* R+10*   R+10*	Schedule:							
Postflight Hardware:   Postflight Software:   Test Location:	Seneuale.		-		N/A	Lal	b personnel/Crewmember	
Postflight Hardware:   Postflight Software:   Test Location:		30 minutes						
Tilt Table  Tilt Table  Finger beat-to-beat blood pressure monitor Teac recorder N/A U.S.  ECG monitor N/A U.S. U.S. Ultrasound unit N/A U.S. Strip chart recorder N/A U.S.  Strip chart recorder N/A U.S.  Minimum Room Dimensions: Number of Electrical Outlets:  Temperature Requirements: Special Lighting:  2 (120V) isolated and protected outlets that have their own independent power source  Hot or Cold Running Water: Privacy Requirements: Vibration/Acoustic Isolation: Other:  None Limit to 3 operators and necessary flight surgeon  Constraints/Special Requirements: See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior								
Finger beat-to-beat blood pressure monitor Teac recorder ECG monitor ULS. ULS. ULS. ULS. ULS. ULS. ULS. ULS.		Postflight Hardware:		Postflight So	oftware:		est Location:	
Teac recorder BCG monitor N/A U.S.  ECG monitor N/A U.S.  Ultrasound unit N/A U.S.  Blood pressure monitor Strip chart recorder N/A U.S.  Winimum Room Dimensions: Number of Electrical Outlets: Temperature Requirements: Special Lighting:  12' x 12' 2 (120V) isolated and protected outlets that have their own independent power source  Hot or Cold Running Water: Privacy Requirements: Vibration/Acoustic Isolation: Other:  None Limit to 3 operators and None None necessary flight surgeon  Constraints/Special Requirements: See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior		Tilt Table	Tilt Table N/				U.S.	
ECG monitor Ultrasound unit Blood pressure monitor Strip chart recorder N/A U.S. U.S. U.S. U.S. V.A U.S. U.S. V.A U.S. U.S. V.A U.S. V.A U.S. V.A V.A V.A V.A V.A V.A V.A V.A V.A V.				N/A	A		U.S.	
Ultrasound unit Blood pressure monitor Strip chart recorder  Minimum Room Dimensions:    Number of Electrical Outlets:   Temperature Requirements:   Special Lighting:				N/A	7/A		U.S.	
Blood pressure monitor Strip chart recorder  Minimum Room Dimensions:    Number of Electrical Outlets:   Temperature Requirements:   Special Lighting:		ECG monitor		**				
Strip chart recorder N/A U.S.  Testing Facilities  Minimum Room Dimensions: Number of Electrical Outlets: Temperature Requirements: Special Lighting:  12' x 12' 2 (120V) isolated and protected outlets that have their own independent power source  Hot or Cold Running Water: Privacy Requirements: Vibration/Acoustic Isolation: Other:  None Limit to 3 operators and necessary flight surgeon  See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior				· ·				
Minimum Room Dimensions: Number of Electrical Outlets: Temperature Requirements: Special Lighting:   12' x 12'								
2 (120V) isolated and protected outlets that have their own independent power source  Hot or Cold Running Water: Privacy Requirements: Vibration/Acoustic Isolation: Other:  None Limit to 3 operators and necessary flight surgeon  Constraints/Special Requirements: See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior		*						
12' x 12'   outlets that have their own independent power source   Hot or Cold Running Water:   Privacy Requirements:   Vibration/Acoustic Isolation:   Other:	<b>Testing Facilities</b>	Minimum Room Dimensions:	Number	of Electrical Outlets:	: Temperature Requirements: Specia		Special Lighting:	
Independent power source   Hot or Cold Running Water:   Privacy Requirements:   Vibration/Acoustic Isolation:   Other:				) isolated and protected				
Hot or Cold Running Water: Privacy Requirements: Vibration/Acoustic Isolation: Other:  None Limit to 3 operators and necessary flight surgeon  None See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior		12' x 12'			72 °F		None	
None Limit to 3 operators and necessary flight surgeon None None None  Constraints/Special Requirements: See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior			· ·					
necessary flight surgeon  Constraints/Special Requirements:  See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior		Hot or Cold Running Water:	Privacy Requirements:		Vibration/Acoustic Isolation:		Other:	
necessary flight surgeon  Constraints/Special Requirements:  See Page 3, Test Termination Criteria. No medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior		None	Limit to 3 operators and		None		None	
			*					
to testing no heavy meets A humieu to testing and no food at all 2 humieu to testing	Constraints/Special Requirements:							
to testing, no neavy means 4 nr prior to testing and no 100d at all 2 nr prior to testing.		to testing, no heavy meals 4 hr prior to testing and no food at all 2 hr prior to testing.						

Early Destow / Early Return:	Data collection will be repeated if launch is delayed by more than 3 months.
Notes:	*R+3, R+10 if clinically indicated.
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):  A preliminary test report of the crewmembers R+0 data will be delivered by the Discipline lead or designated lab personnel to the Flight Surgeon on landing day. The preliminary test report will also be required on test day for any additional contingency sessions prescribed by the crewmember's Flight Surgeon. In addition, a package containing the preliminary test report and final, completed data analysis report will be submitted to the Flight Surgeon and Data Archivist no later than 3 weeks after the final MAT date.

### 3.7 Summary Schedule

#### **TABLE 3.7: SUMMARY SCHEDULE**

$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	BLOOD VOLUME	PERSONNEL REQUIRED	CONSTRAINTS		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Preflight Training – N/A								
In-Flight – N/A  Wheels-Stop – N/A  Postflight  Operational Tilt Test	Preflight								
	Operational Tilt Test	30 Minutes	L-10 days	N/A	N/A		See Note.		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	In-Flight – N/A								
Operational Tilt Test 30 Minutes R+0 R+3 R+7 days N/A N/A Lab personnel/ Crewmember See Note. R+0 should be performed within 3 hours of landing. R+ for flights $\leq 20$ days, a indicated. R+7 for flights $21 - 30$ days, i different from	Wheels-Stop - N/A								
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Postflight								
Postflight Debrief – N/A			R+3	N/A	N/A		flights $21 - 30$ days, if		

Note: Recommend no medications or exercise 24 hr prior to testing, no caffeine, nicotine or alcohol 12 hr prior to testing, no heavy meals 4 hr prior to testing and no food at all 2 hr prior to testing.